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## TRANSPORT EQUIPMENT FOR BATCH-PREPARING DIVISIONS

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Technical specifics of new continuous transporting machines of the conveyor type are described.

In the face of intense market competition every industrial facility must be concerned with increasing production efficiency. High efficiency at a contemporary factory cannot be reached without properly organized and reliable industrial transportation equipment. As a batch-preparing division typically deals with large volumes of friable cargo flows, the most topical are problems solved by continuous transport machinery, i.e., various types of conveyors [1].

Increasing requirements imposed on the reliability and durability of this machinery makes designers search for new approaches and solutions. The domestic conveyors currently offered on the Russian market have poor quality, whereas imported equipment produced by the world leading companies is expensive.

For the purpose of developing reliable equipment with the optimum cost-quality ratio and expanding the product range to ensure integrated state-of-the-art design and production, the *Stromizmeritel'* JSC has developed and implemented serial production of a wide range of high-quality product.

**Belt conveyors** are the most common continuous transport machines in the industry intended for transporting various friable materials with a wide range of characteristics.

The *Stromizmeritel'* JSC produces belt conveyors of different types: horizontal, sloping, with a variable angle, with the belt tension produced by a screw or a load.

The conveyors are equipped with a Matador belt that has a long service life, low stretchability, and increased abrasive wear and thermal resistance. The drive stations are equipped with a Bonfiglioli (Italy) geared motor, SKF or FAG bearing units, and rotary cleaning brushers produced by Karcher Company (Germany).

The design of conveyor belts provides for complete airtightness of the entire route of material using adjustable rubber-tissue sealing edges. Conveyors can be made open or half-open.

The conical shape of the drive drum in combination with its rubber lining excludes lateral deviations of the belt and provides good engagement. Additional reliability and

smoothness of engagement are provided by the deviating drums and transitional idlers installed in the conveyor stations. The absence of a separate drive for rotating the brush increases the reliability and makes it possible to do without additional electric cables and start-protecting equipment. Conveyor sections have supports of adjustable height for the convenience of installation. Mesh fencing and cable switches are provided along the entire length of the conveyor belt. Conveyors are delivered in the form of assembled stations and sections.

The belt sections are joined by cold vulcanizing using high-quality imported materials ensuring long service of joints (consumable materials and the instruction for joining the belt are included in the delivery).

If necessary, the conveyors are equipped with plough-type trippers with pneumatic drives and belt motion gages.

The main technical specifications of belt conveyors are listed in Table 1.

**Vertical belt bucket elevators** are used for lifting different friable materials from the charge site to the discharge site. At present elevators are produced with a lifting height ranging from 7 to 35 m. The bucket width is 250 or 320 mm, and the design of the drive drum in elevators is similar to that of the drive drum of the belt conveyor. Similarly to conveyors, elevators are equipped with geared motors, bearing units, and belts produced by the leading world manufacturers. The tension of the traction occurs on the drive station, which guarantees minimal "still" zones when the buckets go around the lower drum and decreases the overall dimensions of the lower station.

TABLE 1

Model*	Output, m <sup>3</sup> /h	Belt width, mm	Transportation length, m
KLS-500	72	500	3 – 150
KLS-650	186	650	4 – 200
KLS-800	330	800	4 – 200

\* Belt velocity 0.5 – 2.0 m/sec, screw tension stroke 250 – 1000 mm, drive type — geared motor; power — 1.5 – 30.0 kW.

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To prevent damage to the belt by material getting between the belt and the drum, the lower station has a "squirrel wheel" drum of conical shape for additional stabilization of the belt motion. For repair and maintenance of elevators, in addition to hatches and removable panels at the upper and lower stations, access to the working parts is provided at any height and from any side along the entire elevator shaft. The increased structural rigidity of the shaft allows one to minimize the number of support elements and, accordingly, decrease the consumption of metal on its construction. Buckets are fixed to the belt with specially designed bolts to increase reliability.

The discharge of the buckets in the elevators is totally centrifugal.

The main specifics of belt bucket elevators are listed in Table 2.

The metal parts of conveyors and elevators are coated by Tikkurila paint-lacquer materials with increased resistance to mechanical and climatic impacts. In general the conveyors and elevators provide for fast and simple installation and reliable, noiseless, and dust-free operation.

**Vibrating conveyors.** Special attention has been paid to developing a parametric series of vibrating conveyor and feeders. These conveyers are intended for transportation of different friable materials, including abrasive and large-lump ones. A restriction concerns only finely dispersed materials (due to a lower efficiency) or those prone to sticking.

The main advantages of vibration conveyors include their relative simplicity and low cost, the possibility of complete sealing of the transport, the absence of expensive wearing parts, and the simplicity of maintenance. The transporting chutes are equipped with removable lining plates made of materials with different properties corresponding to the characteristics of materials transported.

Vibration feeders and conveyors can be equipped with control blocks providing the control of the output and the multivelocity operating mode to solve problems of precise proportioning.

The main technical parameters of vibrating conveyors are given in Table 3.

**Screw conveyors** and feeders are used to transport materials with bad natural slope angles and propensity for arch formation.

Screw feeders are mainly used as charge and discharge units in scales of different types. Special screw designs, multivelocity operation regime, and a shut-off sealing gate at the exit make it possible to have minimal weighing errors under a high output. To further decrease the error, a special double-screw feeder has been developed.

Screw conveyors differ from screw feeders by a fortified screw design and are equipped with more powerful drives withstanding heavy loads, which allows using them in heavy duty completely filled with material. These conveyors are capable of transporting bulk cargo having large slope angles for a length up to 6 m without intermediate bearing supports.

In addition to supplying conveyors in the standard form, they can be supplied in abrasion-resistant and heat-resistant

TABLE 2

Model*	Output, m <sup>3</sup> /h	Bucket width, mm	Bucket step, mm
ÉLS-250	26.5	500	400
ÉLS-320	47.0	650	450

\* Lifting height 8 – 35 m, belt velocity 1.85 m/sec, drive type — geared motor, power 1.5 – 30.0 kW.

TABLE 3

Model	Output, m <sup>3</sup> /h	Chute width (diameter), mm	Transportation length, m	Drive type	Power, kW
PVT-50	0.8	50	0.57	Electromagnetic	0.40
PVT-80	1.2	80	0.57	The same	0.40
PVL-1	1.5	240	0.55	" "	0.40
PVS-0.36/0.925	20.0	360	0.925	Electromechanical	0.24
PVS-0.36/1.6	20.0	360	1.6	The same	1.20
PVS-0.5/1.2	40.0	500	1.2	" "	1.20
PVS-0.5/1.6	40.0	500	1.6	" "	2.40
PVS-0.5/1.9	40.0	500	1.9	" "	2.40
PVS-0.5/3	40.0	500	3.0	" "	3.40
PVS-0.5/4	40.0	500	4.0	" "	3.40
PVS-0.5/5	40.0	500	5.0	" "	3.40

TABLE 4

Model*	Output, m <sup>3</sup> /h	Screw diameter, mm	Transportation length, m	Power, kW
PS-28	0.03	28	0.32	0.37
PV-47	0.10	47	0.31	0.37
PV-75	1.20	75	0.52	0.75 – 2.20
KVS-125	3.60	125	0.60 – 4.00	2.20
KVS-200	7.50	200	0.80 – 4.00	3.00
KVS-250	12.00	250	1.00 – 4.00	4.00
KVS-315	36.00	315	1.00 – 6.00	5.50 – 9.00

\* Drive type — geared motor.

forms. The supply package includes a screw rotation control sensor. The design of screw conveyors and feeders provides for a reliable drive, a controlled fortified seal of the screw shaft, all-sided access to the conveyor interior for maintenance, and elements to prevent clotting of material in high-speed transportation.

The main technical parameters of screw conveyors are given in Table 4.

To conclude, we should note that the diversity of design modifications of all types of conveyor machinery makes it possible to organize optimum transport flows for friable cargo in designing or upgrading industrial facilities.

## REFERENCES

1. A. O. Spivakovskii and V. K. D'yachkov, *Transport Machines* [in Russian], Mashinostroenie, Moscow (1968).